Texas Hold Em Poker Game Guide for Tournaments

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Texas Hold 'em (also known as **hold 'em** or **holdem**) is a variation of the standard card game of poker. The game consists of two cards being dealt face down to each player and then five community cards being placed face-up by the dealer—a series of three ("the flop") then two additional single cards ("the turn" and "the river" or "fourth and fifth street" respectively), with players having the option to check, bet, raise or fold after each deal; i.e., betting may occur prior to the flop, "on the flop", "on the turn", and "on the river". Texas **H**old 'em is the "H" game featured in H.O.R.S.E and in H.O.S.E.

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Texas Hold Em

Objective

In Texas hold 'em, as in all variants of poker, individuals compete for an amount of money or chips contributed by the players themselves (called the pot). Because the cards are dealt randomly and outside the control of the players, each player attempts to control the amount of money in the pot based either on the hand they are holding, or on their prediction as to what their opponents may be holding.

The game is divided into a series of hands or deals; at the conclusion of each hand, the pot is typically awarded to one player (an exception in which the pot is divided between more than one is discussed below). A hand may end at the showdown, in which case the remaining players compare their hands and the highest hand is awarded the pot; that highest hand is usually held by only one player, but can be held by more in the case of a tie. The other possibility for the conclusion of a hand occurs when all but one player has folded and have thereby abandoned any claim to the pot, in which case the pot is awarded to the player who has not folded.

The objective of winning players is not to win *every* individual hand, but rather to make mathematically and psychologically correct decisions regarding when and how much to bet, raise, call or fold. By making such decisions, winning poker players can maximize their expected gain on each round of betting, thereby increasing their long-term winnings.

History

Johnny Moss, Chill Wills, Amarillo Slim, Jack Binion, and Puggy Pearson outside of Binion's Horseshoe in 1974

Although little is known about the invention of Texas hold 'em, the Texas State Legislature officially recognizes Robstown, Texas, United States as the game's birthplace, dating the game to the early 1900s.

After its invention and spread throughout Texas, hold 'em was introduced to Las Vegas in 1967 by a group of Texan gamblers and card players, including Crandell Addington, Doyle Brunson, and Amarillo Slim. Addington said the first time he saw the game was in 1959. "They didn't call it Texas hold 'em at the time, they just called it hold 'em.… I thought then that if it were to catch on, it would become the game. Draw poker, you bet only twice; hold 'em, you bet four times. That meant you could play strategically. This was more of a thinking man's game."

For several years the Golden Nugget Casino in Downtown Las Vegas was the only casino in Las Vegas to offer the game. At that time, the Golden Nugget's poker room was "truly a 'sawdust joint,' with…oiled sawdust covering the floors." Because of its location and decor, this poker room did not receive many rich drop-in clients, and as a result, professional players sought a more prominent location. In 1969, the Las Vegas professionals were invited to play Texas hold 'em at the entrance of the now-demolished Dunes Casino on the Las Vegas Strip. This prominent location, and the relative inexperience of poker players with Texas hold 'em, resulted in a very remunerative game for professional players.

After a disappointing attempt to establish a "Gambling Fraternity Convention," Tom Moore added the first ever poker tournament to the Second Annual Gambling Fraternity Convention held in 1969. This tournament featured several games including Texas hold 'em. In 1970, Benny and Jack Binion acquired the rights to this convention, renamed it the World Series of Poker, and moved it to their casino, Binion's Horseshoe, in Las Vegas. After its first year, a journalist, Tom Thackrey, suggested that the main event of this tournament should be no-limit Texas hold 'em. The Binions agreed and ever since no-limit Texas hold 'em has been played as the main event. Interest in the Main Event continued to grow steadily over the next two decades. After receiving only eight entrants in 1972, the numbers grew to over one hundred entrants in 1982, and over two hundred in 1991.

During this time, B & G Publishing Co., Inc. published Doyle Brunson's revolutionary poker strategy guide, *Super/System*. Despite being self-published and priced at $100 in 1978, the book revolutionized the way poker was played. It was one of the first books to discuss Texas hold 'em, and is today cited as one of the most important books on this game. In 1983, Al Alvarez published *The Biggest Game in Town*, a book detailing a 1981 World Series of Poker event. The first book of its kind, it described the world of professional poker players and the World Series of Poker. Alvarez's book is credited with beginning the genre of poker literature and with bringing Texas hold 'em (and poker generally) to a wider audience.

Interest in hold 'em outside of Nevada began to grow in the 1980s as well. Although California had legal card rooms offering draw poker, Texas hold 'em was prohibited under a statute that made illegal the (now unheard of) game "stud-horse". But in 1988 Texas hold 'em was declared legally distinct from stud-horse in *Tibbetts v. Van De Kamp*, 271 Cal. Rptr. 792 (1990). Almost immediately card rooms across the state offered Texas hold 'em. (It is often presumed that this decision ruled that hold 'em was a game of skill, but the distinction between skill and chance has never entered into California jurisprudence regarding poker.) After a trip to Las Vegas, bookmakers Terry Rogers and Liam Flood introduced the game to European card players in the early 1980s.

Popularity

Texas Hold 'Em is one of the most popular forms of poker. Texas Hold 'em's popularity surged in the 2000s due to exposure on television, the Internet and popular literature. During this time hold 'em replaced seven-card stud as the most common game in U.S. casinos. The no-limit betting form is used in the widely televised main event of the World Series of Poker (WSOP) and the World Poker Tour (WPT).

Hold 'em's simplicity and popularity have inspired a wide variety of strategy books which provide recommendations for proper play. Most of these books recommend a strategy that involves playing relatively few hands but betting and raising often with the hands one plays. In the first decade of the twenty-first century, Texas hold 'em experienced a surge in popularity worldwide. Many observers attribute this growth to the synergy of five factors: the invention of online poker, the game's appearance in film and on television, the 2004–05 NHL lockout, the appearance of television commercials advertising online cardrooms, and the 2003 World Series of Poker championship victory by online qualifier Chris Moneymaker.

Television and film

Prior to poker becoming widely televised, the movie *Rounders* (1998), starring Matt Damon and Edward Norton, gave moviegoers a romantic view of the game as a way of life. Texas hold 'em was the main game played during the movie and the no-limit variety was described, following Doyle Brunson, as the "Cadillac of Poker." A clip of the classic showdown between Johnny Chan and Erik Seidel from the 1988 World Series of Poker was also incorporated into the film. More recently, a high-stakes Texas Hold'em game was central to the plot of the 2006 James Bond film *Casino Royale*, in place of baccarat, the casino game central to the novel on which the film was based.

Hold 'em tournaments had been televised since the late 1970s, but they did not become popular until 1999, when hidden lipstick cameras were first used to show players' private hole cards on the *Late Night Poker* TV show in the United Kingdom. Hold 'em exploded in popularity as a spectator sport in the United States and Canada in early 2003, when the World Poker Tour adopted the lipstick cameras idea. A few months later, ESPN's coverage of the 2003 World Series of Poker featured the unexpected victory of Internet player Chris Moneymaker, an amateur player who gained admission to the tournament by winning a series of online tournaments. Moneymaker's victory initiated a sudden surge of interest in the World Series, based on the egalitarian idea that anyone—even a rank novice—can become a world champion.

In 2003, there were 839 entrants in the WSOP Main Event, and triple that number in 2004. The crowning of the 2004 WSOP champion, Greg "Fossilman" Raymer, a patent attorney from Connecticut, further fueled the popularity of the event among amateur (and particularly Internet) players. In the 2005 Main Event, an unprecedented 5,619 entrants vied for a first prize of $7,500,000. The winner, Joe Hachem of Australia, was a semi-professional player. This growth continued in 2006, with 8,773 entrants and a first place prize of $12,000,000 (won by Jamie Gold).

Beyond the World Series, other television shows—including the long running *World Poker Tour*—are credited with increasing the popularity of Texas hold 'em. In addition to its presence on network and general audience cable television, poker has now become a regular part of sports networks' programming in the United States.

Literature

Twenty years after the publication of Alvarez's groundbreaking book, James McManus published a semi-autobiographical book, *Positively Fifth Street* (2003), which simultaneously describes the trial surrounding the murder of Ted Binion and McManus' own entry into the 2000 World Series of Poker. McManus, a poker amateur, finished 5th in the No-Limit Texas Hold 'em main event, winning over $200,000. In the book McManus discusses events surrounding the World Series, the trial of Sandy Murphy and Rick Tabish, poker strategy, and some history of poker and the world series.

Michael Craig's 2005 book *The Professor, the Banker, and the Suicide King* details a series of high stakes Texas hold 'em one-on-one games between Texas banker Andy Beal and a rotating group of poker professionals. As of 2006, these games were the highest stakes ever played, reaching $100,000–$200,000 fixed limit.

Online poker

The ability to play cheaply and anonymously online has been credited as a cause of the increase in popularity of Texas hold 'em.Online poker sites both allow people to try out games and also provide an avenue for entry into large tournaments (like the World Series of Poker) via smaller tournaments known as satellites. The 2003 and 2004 winners (Chris Moneymaker and Greg Raymer, respectively) of the World Series No Limit Holdem Main Event qualified by playing in these tournaments.

Although online poker grew from its inception in 1998 until 2003, Moneymaker's win and the appearance of televisions advertisements in 2003 contributed to a tripling of industry revenues in 2004.

Rules

Betting structures

Hold 'em is normally played using small and big blind bets – forced bets by two players. Antes (forced contributions by all players) may be used in addition to blinds, particularly in later stages of tournament play. A dealer button is used to represent the player in the dealer position; the dealer button rotates clockwise after each hand, changing the position of the dealer and blinds. The *small blind* is posted by the player to the left of the dealer and is usually equal to half of the big blind. The *big blind*, posted by the player to the left of the small blind, is equal to the minimum bet. In tournament poker, the blind/ante structure periodically increases as the tournament progresses. (In some cases, the small blind is some other fraction of a small bet; e.g., $10 is a common small blind when the big blind is $15, and still other tables may use two equal blinds. The *double-blind* structure described above is a commonly used and more recent adoption.)

When only two players remain, special 'head-to-head' or 'heads up' rules are enforced and the blinds are posted differently. In this case, the person with the dealer button posts the small blind, while his/her opponent places the big blind. The dealer acts first before the flop. After the flop, the dealer acts last and continues to do so for the remainder of the hand.

The three most common variations of hold 'em are *limit* hold 'em, *no-limit* hold 'em and *pot-limit* hold 'em. Limit hold 'em has historically been the most popular form of hold 'em found in casino live action games in the United States.In limit hold 'em, bets and raises during the first two rounds of betting (pre-flop and flop) must be equal to the big blind; this amount is called the *small bet*. In the next two rounds of betting (turn and river), bets and raises must be equal to twice the big blind; this amount is called the *big bet*. No-limit hold 'em is the form most commonly found in televised tournament poker and is the game played in the main event of the World Series of Poker. In no-limit hold 'em, players may bet or raise any amount over the minimum raise up to all of the chips the player has at the table (called an all-in bet). The minimum raise is equal to the size of the previous bet or raise. If someone wishes to re-raise, they must raise at least the amount of the previous raise. For example, if the big blind is $2 and there is a raise of $6 to a total of $8, a re-raise must be at least $6 more for a total of $14. If a raise or re-raise is all-in and does not equal the size of the previous raise, the initial raiser cannot

re-raise again. This only matters of course if there were a call before the re-raise. In pot-limit hold 'em, the maximum raise is the current size of the pot (including the amount needed to call).

Most casinos that offer hold 'em also allow the player to the left of the big blind to post an optional live straddle, usually double the amount of the big blind, which then acts as the big blind. No-limit games may also allow multiple re-straddles, in any amount that would be a legal raise.

Play of the hand

Play begins with each player being dealt two cards face down, with the player in the small blind receiving the first card and the player in the button seat receiving the last card dealt. (As in most poker games, the deck is a standard 52-card deck containing no jokers.) These cards are the player's *hole* or *pocket* cards. These are the only cards each player will receive individually, and they will only (possibly) be revealed at the showdown, making Texas hold 'em a closed poker game.

The hand begins with a "pre-flop" betting round, beginning with the player to the left of the big blind (or the player to the left of the dealer, if no blinds are used) and continuing clockwise. A round of betting continues until every player has folded, put in all of their chips, or matched the amount put in by all other active players. Note that the blinds are considered "live" in the pre-flop betting round, meaning that they are counted toward the amount that the blind player must contribute. If all players call around to the player in the big blind position, that player may either check or raise.

After the pre-flop betting round, assuming there remain at least two players taking part in the hand, the dealer deals a flop, three face-up community cards. The flop is followed by a second betting round. This and all subsequent betting rounds begin with the player to the dealer's left and continue clockwise.

After the flop betting round ends, a single community card (called the turn or fourth street) is dealt, followed by a third betting round. A final single community card (called the river or fifth street) is then dealt, followed by a fourth betting round and the showdown, if necessary.

In all casinos, the dealer will burn a card before the flop, turn, and river. Because of this burn, players who are betting cannot see the back of the next community card to come. This is done for historical/traditional reasons, to avoid any possibility of a player knowing in advance the next card to be dealt due to it being marked.

The showdown

If a player bets and all other players fold, then the remaining player is awarded the pot and is not required to show his hole cards. If two or more players remain after the final betting round, a showdown occurs. On the showdown, each player plays the best poker hand they can make from the seven cards comprising his two hole cards and the five community cards. A player may use both of his own two hole cards, only one, or none at all, to form his final five-card hand. If the five community cards form the player's best hand, then the player is said to be *playing the board* and can only hope to split the pot, because each other player can also use the same five cards to construct the same hand.

If the best hand is shared by more than one player, then the pot is split equally among them, with any extra chips going to the first players after the button in clockwise order. It is common for players to have closely valued, but not identically ranked hands. Nevertheless, one must be careful in determining the best hand; if the hand involves fewer than five cards, (such as two pair or three of a kind), then kickers are used to settle ties (see the second example below). Note that the card's *numerical* rank is of sole importance; suit values are irrelevant in Hold'em. The last player to bet is the first player to show their hand.

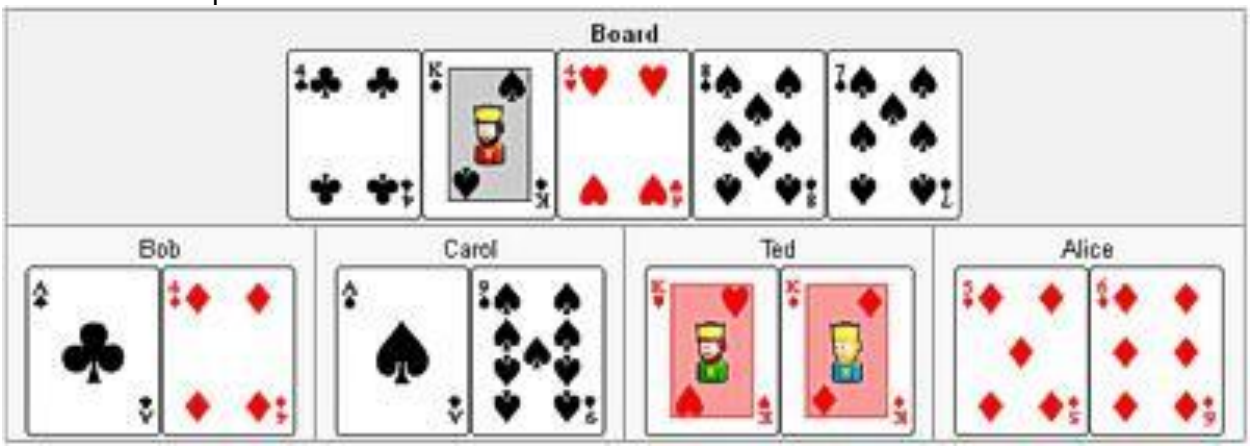
Misdeal

If the first card dealt is exposed, then this is considered a misdeal. The dealer then retrieves the card, reshuffles the deck, and again cuts the cards. However, if any other hole card is exposed due to a dealer error, the deal continues as usual. After completing the deal, the dealer replaces the exposed card with the top card on the deck, and the exposed card is then used as the burn card. If more than one hole card is exposed, a misdeal is declared by the dealer and the hand is dealt again from the beginning. A misdeal is also declared if a player receives more than two hole cards by mistake (e.g. two cards stuck together).

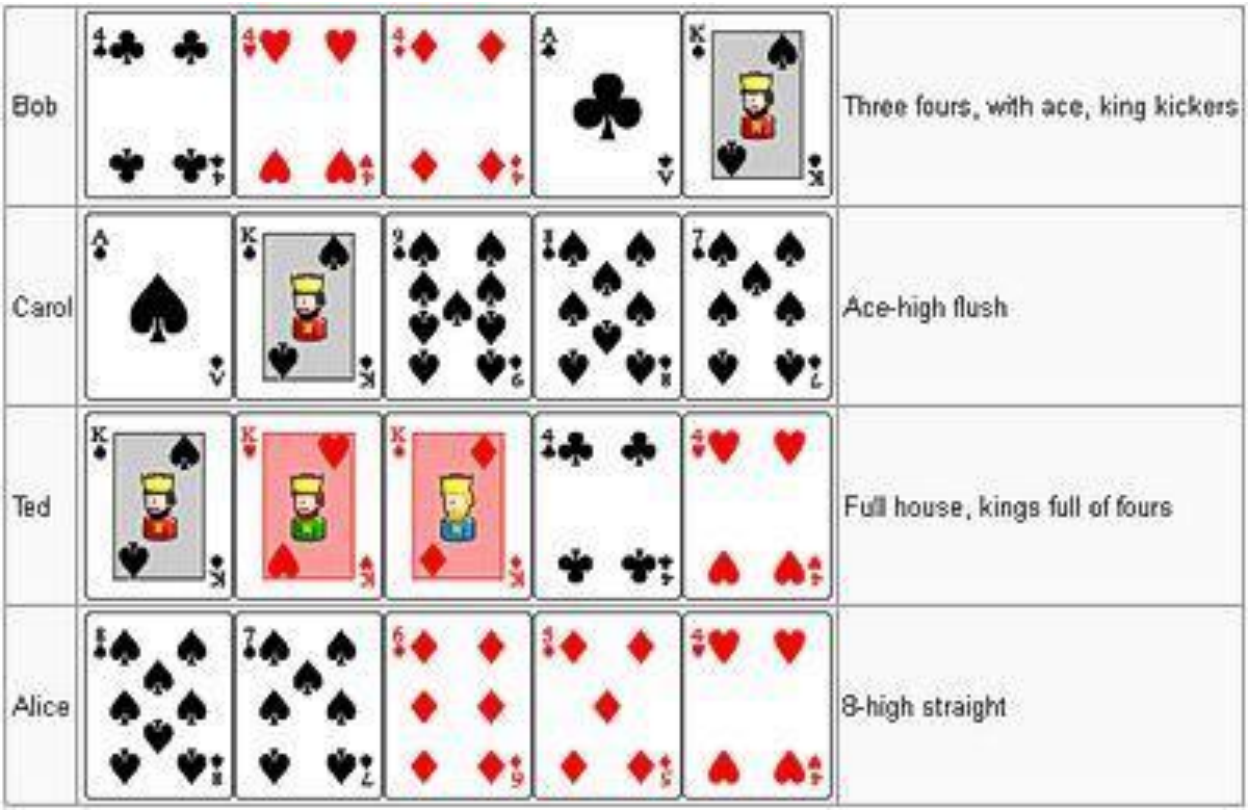
Examples

Sample showdown

Here's a sample showdown:



Each player plays the best 5-card hand they can make with the seven cards available. They have



In this case, Ted's Full House is the best hand, with Carol in 2nd, Alice in 3rd and Bob last.

Sample hand

Here is a sample game involving four players. The players' individual hands will not be revealed until the showdown, to give a better sense of what happens during play:

Compulsory bets: Alice is the dealer. Bob, to Alice's left, posts a small blind of $1, and Carol posts a big blind of $2.

Pre-flop: Alice deals two hole cards face down to each player, beginning with Bob and ending with herself. Ted must act first because he is the first player after the big blind. He cannot check, because the $2 big blind plays as a bet, so he folds. Alice calls the $2. Bob adds an additional $1 to his $1 small blind to call the $2 total. Carol's blind is "live", so she has the *option* to raise here, but she checks instead, ending the first betting round. The pot now contains $6, $2 from each of three players.

Flop: Alice now burns a card and deals the flop of three face-up community cards, **9♣ K♣ 3♥**. On this round, as on all subsequent rounds, the player on the dealer's left begins the betting. In this case it is Bob, who checks. Carol opens for $2, Ted has already folded and Alice raises another $2 (puts in $4, $2 to match Carol and $2 to raise), making the total bet now facing Bob $4. He calls (puts in $4, $2 to match Carol's initial bet and $2 to match Alice's raise). Carol calls as well, putting in her $2. The pot now contains $18, $6 from the last round and $12 from three players this round.

Turn: Alice now burns another card and deals the turn card face up. It is the **5♠**. Bob checks, Carol checks, and Alice checks; the turn has been *checked around*. The pot still contains $18.

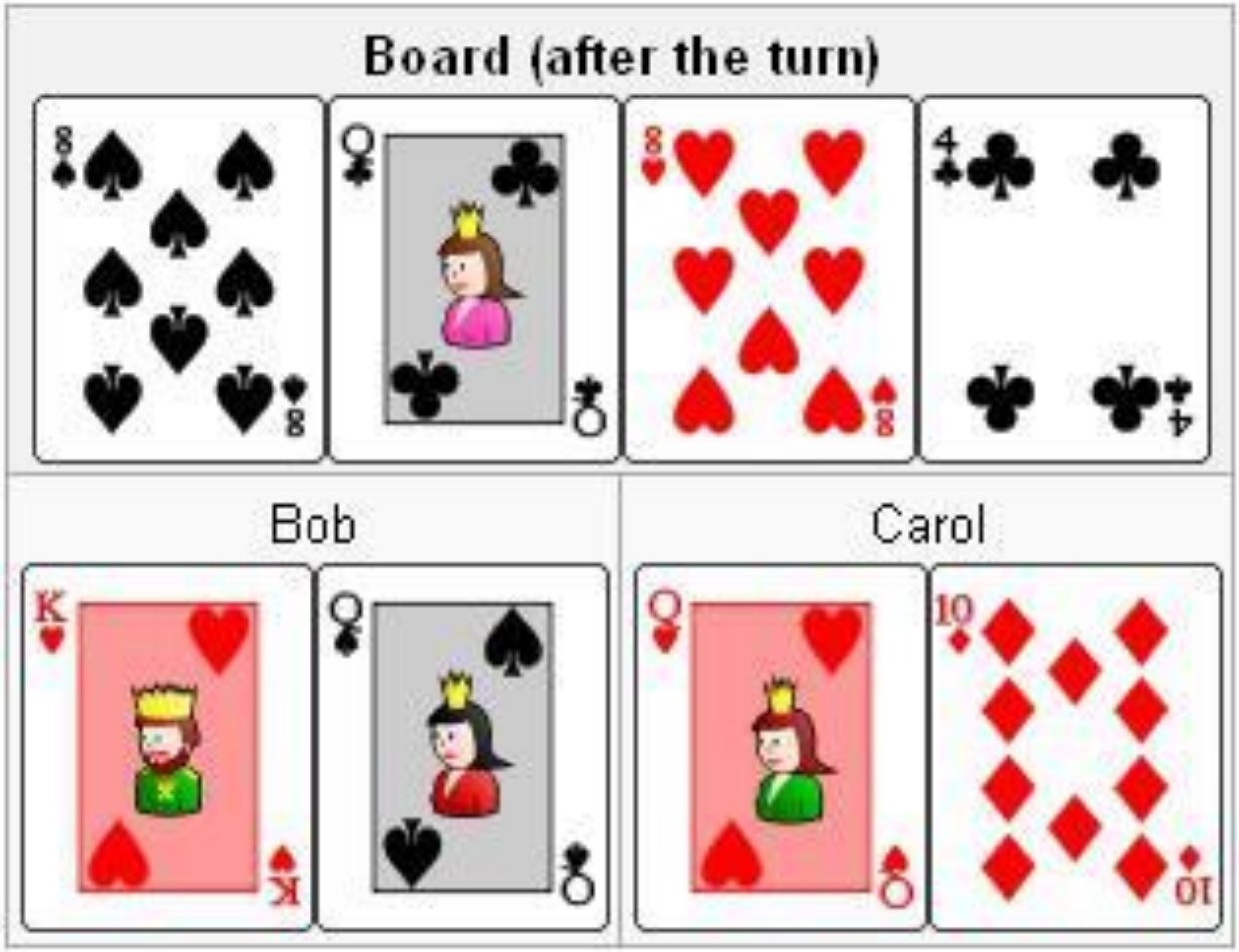
River: Alice burns another card and deals the final river card, the **9♦**, making the final board **9♣ K♣ 3♥ 5♠ 9♦**. Bob bets $4, Carol calls, and Alice folds (Alice's holding was **A♣ 7♣**; she was hoping the river card would be a club to make her hand a flush).

Showdown: Bob shows his hand of **Q♠ 9♥**, so the best five-card hand he can make is **9♣ 9♦ 9♥ K♣ Q♠**, for three nines, with a king-queen kicker. Carol shows her cards of **K♠ J♥**, making her final hand **K♣ K♠ 9♣ 9♦ J♥** for two pair, kings and nines, with a jack kicker. Bob wins the showdown and the $26 pot.

Kickers and ties

Because of the presence of community cards in Texas hold 'em, different players' hands can often run very close in value. As a result, it is common for kickers to be used to determine the winning hand and also for two hands (or maybe more) to tie. A kicker is a card which is part of the five-card poker hand, but is not used in determining a hand's rank. For instance, in the hand **A-A-A-K-Q**, the king and queen are kickers.

The following situation illustrates the importance of breaking ties with kickers and card ranks, as well as the use of the five-card rule. After the turn, the board and players' hole cards are as follows.



At the moment, Bob is in the lead with a hand of **Q♠ Q♣ 8♠ 8♥ K♥**, making two pair, queens and eights, with a king kicker. This beats Carol's hand of **Q♥ Q♣ 8♠ 8♥ 10♦** by virtue of his king kicker.

Suppose the final card were the **A♠**, making the final board **8♠ Q♣ 8♥ 4♣ A♠**. Bob and Carol still each have two pair (queens and eights), but both of them are now entitled to play the final ace as their fifth card, making their hands both two pair, queens and eights, with an ace kicker. Bob's king no longer plays, because the ace on the board plays as the fifth card in both hands, and a hand is only composed of the best five cards. They therefore tie and split the pot. However, had the last card been a jack or lower (except an eight or a queen which would make a full house, or a ten which would give Carol a higher second pair), Bob's king would have stayed in game and he would have won.

Strategy

Most poker authors recommend a tight-aggressive approach to playing Texas hold 'em. This strategy involves playing relatively few hands (tight), but betting and raising often with those that one does play (aggressive). Although this strategy is often recommended, some professional players successfully employ other strategies as well.

Almost all authors agree that where a player sits in the order of play (known as position) is an important element of Texas hold 'em strategy, particularly in no-limit hold'em. Players who act later have more information than players who act earlier. As a result, players typically play fewer hands from early positions than later positions.

Because of the game's level of complexity, it has received some attention from academics. One attempt to develop a quantitative model of a Texas hold'em tournament as an isolated complex system has had some success, although the full consequences for optimal strategies remain to be explored. In addition, groups at the University of Alberta and Carnegie Mellon University are developing poker playing programs utilizing techniques in game theory and artificial intelligence.

Starting hands

Because there are only two cards dealt to each player, it is easy to characterize all of the starting hands. There are $52 \times 51 \div 2 = 1{,}326$ distinct possible combinations of two cards from a standard 52-card deck. Because no suit is more powerful than another, many of these can be equated for the analysis of starting-hand strategy. For example, although **J♥ J♣** and **J♦ J♠** are distinct combinations of cards, they are of equal value as starting hands.

Due to this, there are only 169 different hole-card combinations. Thirteen of those combinations are pairs, from deuces to aces. There are 78 ways to have two cards of different rank (12 possible hands containing an ace, 11 possible hands containing a king and no ace, 10 possible hands containing a queen and no ace or king, etc.). Hole cards can both be used in a flush if they are suited, but pairs are never suited, so there would be 13 possible pairs, 78 possible suited non-pairs, and 78 possible unsuited ("off-suit") non-pairs, for a total of 169 possible hands. Suited starting cards are stronger than their unsuited counterparts, although the magnitude of this strength difference in different games is debated.

Because of this limited number of starting hands, most strategy guides involve a detailed discussion of each of these 169 starting hands. This separates hold 'em from other poker games where the number of starting card combinations forces strategy guides to group hands into broad categories. Another result of this small number is the proliferation of colloquial names for individual hands.

Strategic differences in betting structures

Texas Hold'em is commonly played both as a "cash" or "ring" game and as a tournament game. Strategy for these different forms can vary.

Cash games

Prior to the invention of poker tournaments, all poker games were played with real money where players bet actual currency (or chips which represented currency). Games which feature wagering actual money on individual hands are still very common and are referred to as "cash games" or "ring games".

The no-limit and fixed-limit cash game versions of hold 'em are strategically very different. Doyle Brunson claims that "the games are so different that there are **not** many players who rank with the best in both types of hold 'em. Many no-limit players have difficulty *gearing down* for limit, while limit players often lack the courage and 'feel' necessary to excel at no-limit." Because the size of bets is restricted in limit games, the ability to bluff is somewhat curtailed. Because one is not (usually) risking all of one's chips in limit poker, players are sometimes advised to take more chances.

Lower stakes games also exhibit different properties than higher stakes games. Small stakes games often involve more players in each hand and can vary from extremely passive (little raising and betting) to extremely aggressive (many raises). The difference of small stakes games have resulted in several books dedicated to only those games.

Tournaments

Texas hold 'em is often associated with poker tournaments largely because it is played as the main event in many of the famous tournaments, including the World Series of Poker's Main Event, and is the most common tournament overall. Traditionally, a poker tournament is played with chips that represent a player's stake in the tournament. Standard play allows all entrants to "buy-in" for a fixed amount and all players begin with an equal value of chips. Play proceeds until one player has accumulated all the chips in play or a deal is made among the remaining players to "chop" the remaining prize pool. The money pool is redistributed to the players in relation to the place they finished in the tournament. Only a small percentage of the players receive any money, with the majority receiving nothing. "The percentages are not standardized, but common rules of thumb call for one table" (usually nine players) "to get paid for each 100 entrants," according to poker author Andrew Glazer, in his book, *The Complete Idiot's Guide to Poker*. A good rule of thumb is that close to 10% of players will be paid in a tournament. As a result the strategy in poker tournaments can be very different from a cash game.

Proper strategy in tournaments can vary widely depending on the amount of chips one has, the stage of the tournament, the amount of chips others have, and the playing styles of one's opponents.Although some authors still recommend a tight playing style, others recommend looser play (playing more hands) in tournaments than one would otherwise play in cash games. In tournaments the blinds and antes increase regularly, and can become much larger near the end of the tournament. This can force players to play hands that they would not normally play when the blinds were small, which can warrant both more loose and more aggressive play.

Evaluating your hand

One of the most important things in Texas hold'em is knowing how to evaluate a hand. The strategy of playing each hand can be very different according to the strength of the hand, for example on a strong hand a player might want to try to appear weak in order not to scare off other players with weaker hands and on a weak hand a player might try to bluff other players into folding. There are several ways to evaluate hand strength, two of the most common are counting outs and using calculators.

- Counting outs - this method consists of counting the cards still in the deck, which in combination with the cards the player already has can give the player a potentially winning hand.

Such cards are called "outs", and hand strength can be measured by how many outs are still in the deck (if there are many outs then the probability to get one of them is high and therefore the hand is strong). The following chart determines the probability of hitting outs (bettering the player's hand) based on how many cards are left in the deck and the draw type. Note that a higher number of outs directly corresponds to a high win percentage.

Outs	One Card %	Two Card %	One Card Odds	Two Card Odds	Draw Type
1	2%	4%	46	23	Backdoor Straight or Flush (Requires two cards)
2	4%	8%	22	12	Pocket Pair to Set
3	7%	13%	14	7	One Overcard
4	9%	17%	10	5	Inside Straight / Two Pair to Full House
5	11%	20%	8	4	One Pair to Two Pair or Set
6	13%	24%	6.7	3.2	No Pair to Pair / Two Overcards
7	15%	28%	5.6	2.6	Set to Full House or Quads
8	17%	32%	4.7	2.2	Open Straight
9	19%	35%	4.1	1.9	Flush
10	22%	38%	3.6	1.6	Inside Straight & Two Overcards
11	24%	42%	3.2	1.4	Open Straight & One Overcard
12	26%	45%	2.8	1.2	Flush & Inside Straight / Flush & One Overcard
13	28%	48%	2.5	1.1	
14	30%	51%	2.3	0.95	
15	33%	54%	2.1	0.85	Flush & Open Straight / Flush & Two Overcards
16	34%	57%	1.9	0.75	
17	37%	60%	1.7	0.66	

- Two Times Rule and Four Times Rule: Multiplying the number of outs by two or four gives a reasonable approximation to the One Card % or Two Card %, respectively, in the above table.
- Calculators: calculators are poker tools that calculate the odds of your hand (combined with the cards on the table if there are any) to win the game. Calculators provide precise odds but they can't be used in live games and are therefore mostly used on Internet poker games.

Similar games

There are several other poker variants which resemble Texas hold 'em. Hold 'em is a member of a class of poker games known as community card games, where some cards are available for use by all the players. There are several other games that use five community cards in addition to some private cards and are thus similar to Texas hold 'em. Royal hold 'em has the same structure as Texas hold 'em, but the deck contains only Aces, Kings, Queens, Jacks, and Tens. Pineapple and Omaha hold 'em both vary the number of cards an individual receives before the flop (along with the rules regarding how they may be used to form a hand), but are dealt identically afterward. In Double Texas Hold'em, each player receives 3 hole cards and establishes a middle common card that plays with each of the other cards, but the outer cards don’t play with each other (each player has two 2-card hands). Alternatively, in Double-board hold'em all players receive the same number of private cards, but there are two sets of community cards. The winner is either selected for each individual board with each receiving half of the pot, or the best overall hand takes the entire pot, depending on the rules agreed upon by the players.

Manila is a hold'em variant popular in Australia. In Manila, players receive two private cards from a reduced deck (containing no cards lower than 7). A five card board is dealt, unlike Texas hold 'em, one card at a time; there is a betting round after each card. Manila has several variations of its own, similar to the variants listed above.

Texas hold 'em starting hands

Texas hold 'em starting hands consists of two *hole cards* in the poker game of Texas hold 'em, which belong solely to the player and remain hidden from the other players. Five community cards are also dealt into play. Betting begins before any of the community cards are exposed, and continues throughout the hand. The player's "playing hand", which will be compared against that of each competing player, is the best 5-card poker hand available from his two hole cards and the five community cards. Unless otherwise specified, here the term *hand* applies to the player's two hole cards, or *starting hand*.

Essentials

There are (52 × 51)/2 = 1,326 distinct possible combinations of two hole cards from a standard 52-card deck in hold 'em, but since suits have no relative value in poker, many of these hands are identical in value before the flop. For example, **A♥ J♥** and **A♠ J♠** are identical, because each is a hand consisting of an ace and a jack of the same suit. There are 169 nonequivalent starting hands in hold 'em (13 pocket pairs, 13 × 12 / 2 = 78 suited hands and 78 unsuited hands; 13 + 78 + 78 = 169). These 169 hands are *not* equally likely (see *Poker probability (Texas hold 'em)*). There are 25 starting hands with a probability of winning at a ten-handed table of greater than 1/7. Hold 'em hands are sometimes classified as having one of three "shapes":

- *Pairs,* (or "pocket pairs"), which consist of two cards of the same rank (e.g. **9 9**). One hand in 17 will be a pair, each occurring with individual probability 1/221 (P(pair) = 3/51 = 1/17).
- *Suited* hands, which contain two cards of the same suit (e.g. **A 6**). Four hands out of 17 will be suited, and each suited configuration occurs with probability 2/663 (P(suited) = 12/51 = 4/17).
- *Offsuit* hands, which contain two cards of a different suit and rank (e.g. **K J♥**). Twelve out of 17 hands will be nonpair, offsuit hands, each of which occurs with probability 2/221 (P(offsuit non-pair) = 3*(13-1)/51 = 12/17).

It is typical to abbreviate suited hands in hold 'em by affixing an "s" to the hand, as well as to abbreviate non-suited hands with an "o" (for offsuit). That is,

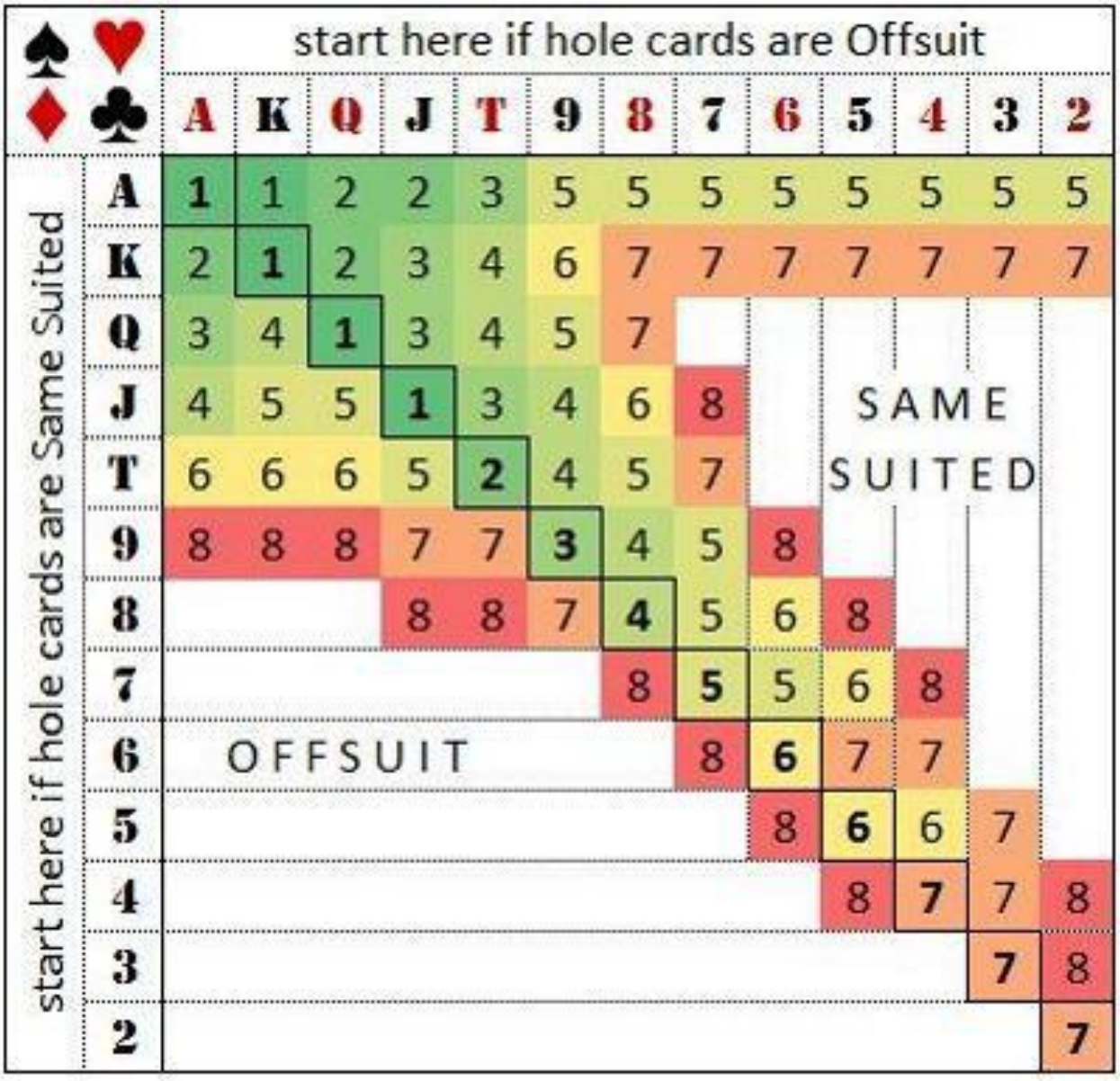
QQ represents any pair of queens,
KQ represents any king and queen,
AKo represents any ace and king of different suits, and
JTs represents any jack and ten of the same suit.

Texas hold 'em hand groups

Sklansky Hand Groups

David Sklansky and Mason Malmuth assigned each hand to a group, and proposed all hands in the group could normally be played similarly. Stronger starting hands are identified by a lower

number. Hands without a number are the weakest starting hands. As a general rule, books on Texas hold'em present hand strengths start with the assumption of a nine or ten person table. The table below illustrates.



Rank	Hole Cards	Playable Positions
1	AA, KK, QQ, JJ; AKs	Early, Middle, Late
2	TT; AQs, AJs, KQs; AKo	Early, Middle, Late
3	99; ATs, KJs, QJs, JTs ; AQo	Early, Middle, Late
4	88; KTs, QTs, J9s, T9s, 98s; AJo, KQo	Early, Middle, Late
5	77; *A9s thru A2s* , Q9s, T8s, 97s, 87s, 76s; KJo, QJo, JTo	Early*, Middle, Late
6	66, 55; K9s, J8s, 86s, 75s, 54s; ATo, KTo, QTo	Middle**, Late
7	44, 33, 22; *K8s thru K2s,* Q8s, T7s, 64s, 53s, 43s; J9o, T9o, 98o	Late***
8	J7s, 96s, 85s, 74s, 42s, 32s; A9o, K9o, Q9o, J8o, T8o, 87o, 76o, 65o, 54o	

* Playable in early position if game is loose/passive.

** Playable in middle position if game is loose/passive.

***Playable in late position if you are the first to bet.

Although Sklansky hand groupings were originally designed for limit poker, they are also useful in no limit hold 'em as a guide, affected by other variables (e.g., number of others left prior to player's preflop decision to bet, call or fold).

Chen formula

The "Chen Formula" is a way to compute the "power ratings" of starting hands that was originally developed by Bill Chen.

Highest Card

Based on the highest card, assign points as follows: Ace = 10 points, K = 8 points, Q = 7 points, J = 6 points. 10 through 2, half of face value (10 = 5 points, 9 = 4.5 points, etc.)

Pairs

For pairs, multiply the points by 2 (AA 20, KK = 16, etc.), with a minimum of 5 points for any pair. 55 is given an extra point (=6).

Suited

Add 2 points for suited cards.

Closeness

Subtract 1 point for 1 gappers (AQ, J9) 2 points for 2 gappers (J8, AJ). 4 points for 3 gappers (J7, 73). 5 points for larger gappers, including A2 A3 A4

Add an extra point if connected or 1-gap and your highest card is lower than Q (since you then can make all higher straights)

Limit Hand Rankings

Phil Hellmuth's: "Play Poker Like the Pros"

Tier	Hands	Category
1	AA, KK, AKs, QQ, AK	Top 12 Hands
2	JJ, TT, 99	(cont.)
3	88, 77, AQs, AQ	(cont.)
4	AJs, ATs, A9s, A8s	Majority Play Hands
5	A7s, A6s, A5s, A4s, A3s, A2s, KQs, KQ	(cont.)
6	QJs, JTs, T9s, 98s, 87s, 76s, 65s	Suited Connectors

Statistics based on real play

Statistics based on real play with their associated actual value in real bets.

Tier	Hands	EV
1	AA, KK, QQ, JJ, AKs	2.32 - 0.78
2	AQs, TT, AK, AJs, KQs, 99	0.59 - 0.38
3	ATs, AQ, KJs, 88, KTs, QJs	0.32 - 0.20
4	A9s, AJ, QTs, KQ, 77, JTs	0.19 - 0.15
5	A8s, K9s, AT, A5s, A7s	0.10 - 0.08
6	KJ, 66, T9s, A4s, Q9s	0.08 - 0.05
7	J9s, QJ, A6s, 55, A3s, K8s, KT	0.04 - 0.01
8	98s, T8s, K7s, A2s	0.00
9	87s, QT, Q8s, 44, A9, J8s, 76s, JT	(-) 0.02 - 0.03

Nicknames for starting hands

In poker communities, it is common for hole cards to be given nicknames. While most combinations have a nickname, stronger handed nicknames are generally more recognized, the most notable probably being the "Big Slick" - Ace and King of the same suit, although an Ace-King of any suit combination is less occasionally referred to as an Anna Kournikova, derived from the initials AK and because it "looks really good but rarely wins." Hands can be named according to the strength of the hand (e.g., paired aces are sometimes known as rockets representing their strength); a historic event (e.g., A's and 8's - dead man's hand, representing the hand held by Wild Bill Hickok when he was fatally shot in the back by Jack McCall in 1876); many other reasons like animal names, alliteration and rhyming are also used in nicknames.

Texas hold 'em poker probability

In **poker**, the **probability** of many events can be determined by direct calculation. This article discusses computing probabilities for many commonly occurring events in the game of Texas hold 'em and provides some probabilities and odds[Note 1] for specific situations. In most cases, the probabilities and odds are approximations due to rounding.

When calculating probabilities for a card game such as Texas Hold 'em, there are two basic approaches. The first approach is to determine the number of outcomes that satisfy the condition being evaluated and divide this by the total number of possible outcomes. For example, there are six outcomes (ignoring order) for being dealt a pair of aces in Hold' em: {**A♣**, **A♥**}, {**A♣**, **A♠**}, {**A♣**, **A♦**}, {**A♥**, **A♠**}, {**A♥**, **A♦**} and {**A♠**, **A♦**}. There are 52 ways to pick the first card and 51 ways to pick the second card and two ways to order the two cards yielding $\frac{52\times51}{2} = 1326$ possible outcomes when being dealt two cards (also ignoring order). This gives a probability of being dealt two aces of $\frac{6}{1326} = \frac{1}{221}$.

The second approach is to use conditional probabilities, or in more complex situations, a decision tree. There are 4 ways to be dealt an ace out of 52 choices for the first card resulting in a probability of $\frac{4}{52} = \frac{1}{13}$. There are 3 ways of getting dealt an ace out of 51 choices on the second card after being dealt an ace on the first card for a probability of $\frac{3}{51} = \frac{1}{17}$. The conditional probability of being dealt two aces is the product of the two probabilities: $\frac{1}{13} \times \frac{1}{17} = \frac{1}{221}$.

Often, the key to determining probability is selecting the best approach for a given problem. This article uses both of these approaches.

Starting hands

The probability of being dealt various starting hands can be explicitly calculated. In Texas Hold 'em, a player is dealt two down (or *hole* or *pocket*) cards. The first card can be any one of 52 playing cards in the deck and the second card can be any one of the 51 remaining cards. This gives 52 × 51 ÷ 2 = 1,326 possible starting hand combinations. (Since the order in which you receive the first two cards is not significant, the 2,652 permutations are divided by the 2 ways of ordering two cards.) Alternatively, the number of possible starting hands is represented as the binomial coefficient

$$\binom{52}{2} = 1,326$$

which is the number of possible combinations of choosing 2 cards from a deck of 52 playing cards.

The 1,326 starting hands can be reduced for purposes of determining the probability of starting hands for Hold 'em—since suits have no relative value in poker, many of these hands are identical in value before the flop. The only factors determining the strength of a starting hand are the ranks of the cards and whether the cards share the same suit. Of the 1,326 combinations, there are 169 distinct starting hands grouped into three *shapes:* 13 *pocket pairs* (paired hole cards), 13 × 12 ÷ 2 = 78 *suited hands* and 78 *unsuited hands;* 13 + 78 + 78 = 169. The relative probability of being dealt a hand of each given shape is different. The following shows the probabilities and odds of being dealt each type of starting hand.

Hand shape	Number of hands	Suit combinations for each hand	Combinations	Dealt specific hand		Dealt any hand	
				Probability	Odds	Probability	Odds
Pocket pair	13	$\binom{4}{2} = 6$	$13 \times 6 = 78$	$\frac{6}{1326} \approx 0.00452$	220 : 1	$\frac{78}{1326} \approx 0.0588$	16 : 1
Suited cards	78	$\binom{4}{1} = 4$	$78 \times 4 = 312$	$\frac{4}{1326} \approx 0.00302$	331 : 1	$\frac{312}{1326} \approx 0.2353$	3.25 : 1
Unsuited cards non paired	78	$\binom{4}{1}\binom{3}{1} = 12$	$78 \times 12 = 936$	$\frac{12}{1326} \approx 0.00905$	110 : 1	$\frac{936}{1326} \approx 0.7059$	0.417 : 1

Hand shape

Here are the probabilities and odds of being dealt various other types of starting hands.

Hand	Probability	Odds
AKs (or any specific suited cards)	0.00302	331 : 1
AA (or any specific pair)	0.00452	220 : 1
AKs, KQs, QJs, or JTs (suited cards)	0.0121	81.9 : 1
AK (or any specific non-pair incl. suited)	0.0121	81.9 : 1
AA, KK, or QQ	0.0136	72.7 : 1
AA, KK, QQ or JJ	0.0181	54.3 : 1
Suited cards, jack or better	0.0181	54.3 : 1
AA, KK, QQ, JJ, or TT	0.0226	43.2 : 1
Suited cards, 10 or better	0.0302	32.2 : 1
Suited connectors	0.0392	24.5 : 1
Connected cards, 10 or better	0.0483	19.7 : 1
Any 2 cards with rank at least queen	0.0498	19.1 : 1
Any 2 cards with rank at least jack	0.0905	10.1 : 1
Any 2 cards with rank at least 10	0.143	5.98 : 1
Connected cards (cards of consecutive rank)	0.157	5.38 : 1
Any 2 cards with rank at least 9	0.208	3.81 : 1
Not connected nor suited, at least one 2-9	0.534	0.873 : 1

Starting hands heads up

For any given starting hand, there are 50 × 49 ÷ 2 = 1,225 hands that an opponent can have before the flop. (After the flop, the number of possible hands an opponent can have is reduced by the three community cards revealed on the flop to 47 × 46 ÷ 2 = 1,081 hands.) Therefore, there are

$$\binom{52}{2}\binom{50}{2} \div 2 = 812,175$$

possible head-to-head match ups in Hold 'em. (The total number of match ups is divided by the two ways that two hands can be distributed between two players to give the number of unique match ups.) However, since there are only 169 distinct starting hands, there are 169 × 1,225 = 207,025 distinct head-to-head match ups.[Note 2]

It is useful and interesting to know how two starting hands compete against each other heads up before the flop. In other words, we assume that neither hand will fold, and we will see a showdown. This situation occurs quite often in no limit and tournament play. Also, studying these odds helps to demonstrate the concept of hand domination, which is important in all community card games.

This problem is considerably more complicated than determining the frequency of dealt hands. To see why, note that given both hands, there are 48 remaining unseen cards. Out of these 48 cards, we can choose any 5 to make a board. Thus, there are

$$\binom{48}{5} = 1,712,304$$

possible boards that may fall. In addition to determining the precise number of boards that give a win to each player, we also must take into account boards which split the pot, and split the number of these boards between the players.

The problem is trivial for computers to solve by brute force search; there are many software programs available that will compute the odds in seconds. A somewhat less trivial exercise is an exhaustive analysis of all of the head-to-head match ups in Texas Hold 'em, which requires evaluating each possible board for each distinct head-to-head match up, or 1,712,304 × 207,025 = 354,489,735,600 (≈354 billion) results.[Note 2]

Head-to-head starting hand matchups

When comparing two starting hands, the *head-to-head probability* describes the likelihood of one hand beating the other after all of the cards have come out. Head-to-head probabilities vary slightly for each particular distinct starting hand matchup, but the approximate average probabilities, as given by Dan Harrington in *Harrington on Hold'em* [p. 125], are summarized in the following table.

Favorite-to-underdog matchup	Probability	Odds for
Pair vs. 2 undercards	0.83	4.9 : 1
Pair vs. lower pair	0.82	4.5 : 1
Pair vs. 1 overcard, 1 undercard	0.71	2.5 : 1
2 overcards vs. 2 undercards	0.63	1.7 : 1
Pair vs. 2 overcards	0.55	1.2 : 1

Favorite-to-underdog matchup

These odds are general approximations only derived from averaging all of the hand matchups in each category. The actual head-to-head probabilities for any two starting hands vary depending on a number of factors, including:

- Suited or unsuited starting hands;
- Shared suits between starting hands;
- Connectedness of non-pair starting hands;
- Proximity of card ranks between the starting hands (lowering straight potential);
- Proximity of card ranks toward **A** or **2** (lowering straight potential);
- Possibility of split pot.

For example, **A♠ A♣** vs. **K♠ Q♣** is 87.65% to win (0.49% to split), but **A♠ A♣** vs. **7♦ 6♦** is 76.81% to win (0.32% to split).

The mathematics for computing all of the possible matchups is simple. However, the computation is tedious to carry out by hand. A computer program can perform a brute force evaluation of the 1,712,304 possible boards for any given pair of starting hands in seconds.

Starting hands against multiple opponents

When facing two opponents, for any given starting hand the number of possible combinations of hands the opponents can have is

$$\binom{50}{2}\binom{48}{2} = 1,381,800$$

hands. For calculating probabilities we can ignore the distinction between the two opponents holding **A♠ J♥** and **8♥ 8♣** and the opponents holding **8♥ 8♣** and **A♠ J♥**. The number of ways that hands can be distributed between *n* opponents is *n*! (the factorial of n). So the number of unique hand combinations *H* against two opponents is

$$H = \binom{50}{2}\binom{48}{2} \div 2! = 690,900$$

and against three opponents is

$$H = \binom{50}{2}\binom{48}{2}\binom{46}{2} \div 3! = 238,360,500$$

and against *n* opponents is

$$H = \prod_{k=1}^{n} \binom{52-2k}{2} \div n!,$$ or alternatively $$H = \binom{50}{2n} \times (2n-1)!!,$$

where $(2n-1)!!$ is the number of ways to distribute $2n$ cards between n hands of two cards each.[Note 3] [**!!** is the double factorial operator: (2n-1)!! is not ((2n-1)!)!.] The following table shows the number of hand combinations for up to nine opponents.

Opponents	Number of possible hand combinations
1	1,225
2	690,900
3	238,360,500
4	56,372,258,250
5	≈9.7073×10^{12} (more than 9 trillion)
6	≈1.2620×10^{15} (more than 1 quadrillion)
7	≈1.2674×10^{17} (more than 126 quadrillion)
8	≈9.9804×10^{18} (almost 10 quintillion)
9	≈6.2211×10^{20} (more than 622 quintillion)

Number of possible hand combinations

An exhaustive analysis of all of the match ups in Texas Hold 'em of a player against nine opponents requires evaluating each possible board for each distinct starting hand against each possible combination of hands held by nine opponents, which is

$$169 \times \binom{50}{18} \times 17!! \times \binom{32}{5} \approx 2.117 \times 10^{28}$$ (more than 21 octillion).

If you were able to evaluate one trillion (1012) combinations every second, it would take over 670 million years to evaluate all of the hand/board combinations. While it is possible to significantly reduce the total number of combinations by pruning combinations with identical properties, the total number of situations is still well beyond the number that can be evaluated by brute force. For this reason, most software programs compute probabilities and expected values for Hold 'em poker hands against multiple opponents by simulating the play of thousands or even millions of hands to determine statistical probabilities.

Dominated hands

When evaluating a hand before the flop, it is useful to have some idea of how likely the hand is *dominated*. A dominated hand is a hand that is beaten by another hand (the *dominant* hand) and is unlikely to win against it. Often the dominated hand has only a single card rank that can improve the dominated hand to beat the dominant hand (not counting straights and flushes). For example, **KJ** is dominated by **KQ**—both hands share the king, and the queen kicker is beating the jack kicker. Barring a straight or flush, the **KJ** will need a jack on the board to improve against the **KQ** (and would still be losing if a queen appears on the board along with the jack). A pocket pair is dominated by a pocket pair of higher rank.

Pocket pairs

Barring a straight or flush, a pocket pair needs to make three of a kind to beat a higher pocket pair. See the section "After the flop" for the odds of a pocket pair improving to three of a kind.

To calculate the probability that another player has a higher pocket pair, first consider the case against a single opponent. The probability that a single opponent has a higher pair can be stated as the probability that the first card dealt to the opponent is a higher rank than the pocket pair and the second card is the same rank as the first. Where ***r*** is the rank of the pocket pair (assigning values from 2–10 and J–A = 11–14), there are $(14 - r) \times 4$ cards of higher rank. Subtracting the two cards for the pocket pair leaves 50 cards in the deck. After the first card is dealt to the player there are 49 cards left, 3 of which are the same rank as the first. So the probability P of a single opponent being dealt a higher pocket pair is

$$P = \frac{(14 - r) \times 4}{50} \times \frac{3}{49}$$
$$= \frac{84 - 6r}{1225}.$$

The following approach extends this equation to calculate the probability that one or more other players has a higher pocket pair.

1. Multiply the base probability for a single player for a given rank of pocket pairs by the number of opponents in the hand;
2. Subtract the adjusted probability that more than one opponent has a higher pocket pair. (This is necessary because this probability effectively gets added to the calculation multiple times when multiplying the single player result.

Where ***n*** is the number of other players still in the hand and ***Pma*** is the adjusted probability that multiple opponents have higher pocket pairs, then the probability that at least one of them has a higher pocket pair is

$$P = \left(\frac{84 - 6r}{1225}\right) \times n - P_{ma.} = \frac{n(84 + 6r) - 1,225P_{ma}}{1,225}$$

The calculation for *Pma* depends on the rank of the player's pocket pair, but can be generalized as

$$P_{ma} = P_2 + 2P_3 + \cdots + (n-1)P_n,$$

where ***P*2** is the probability that exactly two players have a higher pair, ***P*3** is the probability that exactly three players have a higher pair, etc. As a practical matter, even with pocket **2**s against 9 opponents, *P*4 < 0.0015 and *P*5 < 0.00009, so just calculating *P*2 and *P*3 gives an adequately precise result.

The following table shows the probability that before the flop another player has a larger pocket pair when there are one to nine other players in the hand.

Probability of facing a larger pair when holding	Against 1	Against 2	Against 3	Against 4	Against 5	Against 6	Against 7	Against 8	Against 9
KK	0.0049	0.0098	0.0147	0.0196	0.0244	0.0293	0.0342	0.0391	0.0439
QQ	0.0098	0.0195	0.0292	0.0388	0.0484	0.0579	0.0673	0.0766	0.0859
JJ	0.0147	0.0292	0.0436	0.0577	0.0717	0.0856	0.0992	0.1127	0.1259
TT	0.0196	0.0389	0.0578	0.0764	0.0946	0.1124	0.1299	0.1470	0.1637
99	0.0245	0.0484	0.0718	0.0946	0.1168	0.1384	0.1593	0.1795	0.1990
88	0.0294	0.0580	0.0857	0.1125	0.1384	0.1634	0.1873	0.2101	0.2318
77	0.0343	0.0674	0.0994	0.1301	0.1595	0.1874	0.2138	0.2387	0.2619
66	0.0392	0.0769	0.1130	0.1473	0.1799	0.2104	0.2389	0.2651	0.2890
55	0.0441	0.0862	0.1263	0.1642	0.1996	0.2324	0.2623	0.2892	0.3129
44	0.0490	0.0956	0.1395	0.1806	0.2186	0.2532	0.2841	0.3109	0.3334
33	0.0539	0.1048	0.1526	0.1967	0.2370	0.2729	0.3040	0.3300	0.3503
22	0.0588	0.1141	0.1654	0.2124	0.2546	0.2914	0.3222	0.3464	0.3633

Probability of facing a larger pair when holding

The following table gives the probability that a hand is facing two or more larger pairs before the flop. From the previous equations, the probability *Pm* is computed as

$$P_m = P_2 + P_3 + \cdots + P_n.$$

Probability of facing multiple larger pairs when holding	Against 2	Against 3	Against 4	Against 5	Against 6	Against 7	Against 8	Against 9
KK	< 0.00001	0.00001	0.00003	0.00004	0.00007	0.00009	0.00012	0.00016
QQ	0.00006	0.00018	0.00037	0.00061	0.00091	0.00128	0.00171	0.00220
JJ	0.00017	0.00051	0.00102	0.00171	0.00257	0.00360	0.00482	0.00621
TT	0.00033	0.00099	0.00200	0.00335	0.00504	0.00709	0.00950	0.01226
99	0.00054	0.00164	0.00330	0.00553	0.00836	0.01177	0.01580	0.02045
88	0.00081	0.00244	0.00493	0.00828	0.01253	0.01769	0.02378	0.03084
77	0.00112	0.00341	0.00689	0.01160	0.01758	0.02487	0.03351	0.04353
66	0.00149	0.00454	0.00918	0.01550	0.02353	0.03335	0.04503	0.05861
55	0.00191	0.00583	0.01182	0.01998	0.03040	0.04318	0.05840	0.07619
44	0.00239	0.00728	0.01480	0.02506	0.03821	0.05439	0.07371	0.09635
33	0.00291	0.00890	0.01812	0.03075	0.04698	0.06699	0.09089	0.11919
22	0.00349	0.01069	0.02180	0.03706	0.05673	0.08107	0.11034	0.14494

Probability of facing multiple larger pairs when holding

From a practical perspective, however, the odds of out drawing a single pocket pair or multiple pocket pairs are not much different. In both cases the large majority of winning hands require one of the remaining two cards needed to make three of a kind. The real difference against multiple overpairs becomes the increased probability that one of the overpairs will also make three of a kind.

Hands with one ace

When holding a single ace (referred to as **Ax**), it is useful to know how likely it is that another player has a *better ace*—an ace with a higher second card, since a weaker ace is dominated by a better ace. The probability that a single opponent has a better ace is the probability that he has either **AA** or **Ax** where **x** is a rank other than ace that is higher than the player's second card. When holding **Ax**, the probability that a chosen single player has **AA** is $\frac{3}{50} \times \frac{2}{49} \approx 0.00245$. In the case of a table with ***n*** opponents, the probability of *one* of them holding **AA** is $(1 - (1 - 0.00245)n)$. If the player is holding **Ax** against 9 opponents, there is a probability of approximately 0.0218 that one opponent has **AA**.

Where x is the rank 2–K of the second card (assigning values from 2–10 and J–K = 11–13) the probability that a single opponent has a better ace is calculated by the formula

$$\begin{aligned} P &= \left(\frac{3}{50} \times \frac{2}{49}\right) + \left(\frac{3}{50} \times \frac{(13-x)\times 4}{49} \times 2\right) \\ &= \frac{3}{1225} + \frac{12 \times (13-x)}{1225} \\ &= \frac{159-12x}{1225}. \end{aligned}$$

The probability $\frac{3}{50} \times \frac{(13-x)\times 4}{49}$ of a player having **Ay**, where **y** is a rank such that **x** < **y** <= **K**, is multiplied by the two ways to order the cards **A** and **y** in the hand.

The following table shows the probability that before the flop another player has an ace with a larger kicker in the hand.

Probability of facing an ace with larger kicker when holding	Against 1	Against 2	Against 3	Against 4	Against 5	Against 6	Against 7	Against 8	Against 9
AK	0.00245	0.00489	0.00733	0.00976	0.01219	0.01460	0.01702	0.01942	0.02183
AQ	0.01224	0.02434	0.03629	0.04809	0.05974	0.07126	0.08263	0.09386	0.10496
AJ	0.02204	0.04360	0.06468	0.08529	0.10545	0.12517	0.14445	0.16331	0.18175
AT	0.03184	0.06265	0.09250	0.12139	0.14937	0.17645	0.20267	0.22805	0.25263
A9	0.04163	0.08153	0.11977	0.15642	0.19154	0.22520	0.25745	0.28837	0.31799
A8	0.05143	0.10021	0.14649	0.19038	0.23202	0.27152	0.30898	0.34452	0.37823
A7	0.06122	0.11870	0.17266	0.22331	0.27086	0.31560	0.35741	0.39675	0.43369
A6	0.07102	0.13703	0.19829	0.25523	0.30812	0.35726	0.40291	0.44531	0.48471
A5	0.08082	0.15510	0.22338	0.28615	0.34384	0.39587	0.44561	0.49041	0.53160
A4	0.09061	0.17301	0.24795	0.31609	0.37806	0.43442	0.48567	0.53227	0.57465
A3	0.10041	0.19073	0.27199	0.34509	0.41085	0.47000	0.52322	0.57109	0.61416
A2	0.11020	0.20826	0.29552	0.37315	0.44223	0.50370	0.55840	0.60706	0.65037

Probability of facing an ace with larger kicker when holding

The flop

The value of a starting hand can change dramatically after the flop. Regardless of initial strength, any hand can flop the nuts—for example, if the flop comes with three **2**s, any hand holding the fourth **2** has the nuts. Conversely, the flop can undermine the perceived strength of any hand—a player holding **A♣ A♥** would not be happy to see **8♠ 9♠ 10♠** on the flop because of the straight and flush possibilities.

There are

$$\binom{50}{3} = 19,600$$

possible flops for any given starting hand. By the turn the total number of combinations has increased to

$$\binom{50}{4} = 230,300$$

and on the river there are

$$\binom{50}{5} = 2,118,760$$

possible boards to go with the hand.

The following are some general probabilities about what can occur on the board. These assume a "random" starting hand for the player.

Board consisting of	Making on flop		Making by turn		Making by river	
	Prob.	Odds	Prob.	Odds	Prob.	Odds
Three or more of same suit	0.05177	18.3 : 1	0.13522	6.40 : 1	0.23589	3.24 : 1
Four or more of same suit			0.01056	93.7 : 1	0.03394	28.5 : 1
Rainbow flop (all different suits)	0.39765	1.51 : 1	0.10550	8.48 : 1		
Three cards of consecutive rank (but not four consecutive)	0.03475	27.8 : 1	0.11820	7.46 : 1	0.25068	2.99 : 1
Four cards to a straight (but not five)			0.03877	24.8 : 1	0.16991	4.27 : 1
Three or more cards of consecutive rank and same suit	0.00217	459 : 1	0.00869	114 : 1	0.02172	45.0 : 1
Three of a kind (but not a full house or four of a kind)	0.00235	424 : 1	0.00935	106 : 1	0.02128	46 : 1
A pair (but not two pair or three or four of a kind)	0.16941	4.90 : 1	0.30417	2.29 : 1	0.42450	1.36 : 1
Two pair (but not a full house)			0.01037	95.4 : 1	0.04716	20.2 : 1

An interesting fact to note from the table above is that more than 60% of the flops will have at least two of the same suit—you're likely to either be drawing to a flush or worried about one.

Flopping overcards when holding a pocket pair

It is also useful to look at the chances different starting hands have of either improving on the flop, or of weakening on the flop. One interesting circumstance concerns pocket pairs. When holding a pocket pair, overcards (cards of higher rank than the pair) weaken the hand because of the potential that an overcard has paired a card in an opponent's hand. The hand gets worse the more overcards there are on the board and the more opponents that are in the hand because the probability that one of the overcards has paired a hole card increases. To calculate the probability of no overcard, take the total number of outcomes without an overcard divided by the total number of outcomes.

Where ***x*** is the rank 3–K of the pocket pair (assigning values from 3–10 and J–K = 11–13), then the number of overcards is $(14-x)\times 4$ and the number of cards of rank *x* or less is $50-(14-x)\times 4 = 4x-6$. The number of outcomes without an overcard is the number of combinations that can be formed with the remaining cards, so the probability *P* of an overcard on the flop is

$$P = \binom{(4x-6)}{3} \div \binom{50}{3},$$

and on the turn and river are

$P = \binom{(4x-6)}{4} \div \binom{50}{4}$ and $P = \binom{(4x-6)}{5} \div \binom{50}{5}$, respectively.

The following table gives the probability that no overcards will come on the flop, turn and river, for each of the pocket pairs from **3** to **K**

Holding pocket pair	No overcard on flop		No overcard by turn		No overcard by river	
	Prob.	Odds	Prob.	Odds	Prob.	Odds
KK	0.7745	0.29 : 1	0.7086	0.41 : 1	0.6470	0.55 : 1
QQ	0.5857	0.71 : 1	0.4860	1.06 : 1	0.4015	1.49 : 1
JJ	0.4304	1.32 : 1	0.3205	2.12 : 1	0.2369	3.22 : 1
TT	0.3053	2.28 : 1	0.2014	3.97 : 1	0.1313	6.61 : 1
99	0.2071	3.83 : 1	0.1190	7.40 : 1	0.0673	13.87 : 1
88	0.1327	6.54 : 1	0.0649	14.40 : 1	0.0310	31.21 : 1
77	0.0786	11.73 : 1	0.0318	30.48 : 1	0.0124	79.46 : 1
66	0.0416	23.02 : 1	0.0133	74.26 : 1	0.0040	246.29 : 1
55	0.0186	52.85 : 1	0.0043	229.07 : 1	0.0009	1,057.32 : 1
44	0.0061	162.33 : 1	0.0009	1,095.67 : 1	0.0001	8,406.78 : 1
33	0.0010	979.00 : 1	0.0001	15,352.33 : 1	0.0000	353,125.67 : 1

. *Holding pocket pair*

Notice that there is a better than 35% probability that an ace will come by the river if holding pocket kings, and with pocket queens, the odds are slightly in favor of an ace or a king coming by the turn, and a full 60% in favor of an overcard to the queen by the river. With pocket jacks, there's only a 43% chance that an overcard will not come on the flop and it is better than 3 : 1 that an overcard will come by the river.

Notice, though, that those probabilities would be lower if we consider that at least one opponent happens to hold one of those overcards.

After the flop – outs

During play—that is, from the flop and onwards—drawing probabilities come down to a question of outs. All situations which have the same number of outs have the same probability of improving to a winning hand over any unimproved hand held by an opponent. For example, an inside straight draw (e.g. **3-4-6-7** missing the **5** for a straight), and a full house draw (e.g. **6-6-K-K** drawing for one of the pairs to become three-of-a-kind) are equivalent. Each can be satisfied by four cards—four **5**s in the first case, and the other two **6**s and other two kings in the second.

The probabilities of drawing these outs are easily calculated. At the flop there remain 47 unseen cards, so the probability is (outs ÷ 47). At the turn there are 46 unseen cards so the probability is (outs ÷ 46). The cumulative probability of making a hand on either the turn or river can be determined as the complement of the odds of *not* making the hand on the turn and not on the river. The probability of not drawing an out is (47 − outs) ÷ 47 on the turn and (46 − outs) ÷ 46 on the river; taking the complement of these conditional probabilities gives the probability of drawing the out by the river which is calculated by the formula

$$P = 1 - \left(\frac{47 - outs}{47} \times \frac{46 - outs}{46}\right) = \frac{93outs - outs^2}{2,162}.$$

For reference, the probability and odds for some of the more common numbers of outs are given here.

Example drawing to	Outs	Make on turn		Make on river		Make on turn or river	
		Prob.	Odds	Prob.	Odds	Prob.	Odds
Inside straight flush; Four of a kind	1	0.0213	46.0 : 1	0.0217	46.0 : 1	0.0426	22.5 : 1
Open-ended straight flush; Three of a kind	2	0.0426	22.5 : 1	0.0435	22.0 : 1	0.0842	10.9 : 1
High pair	3	0.0638	14.7 : 1	0.0652	14.3 : 1	0.1249	7.01 : 1
Inside straight; Full house	4	0.0851	10.7 : 1	0.0870	10.5 : 1	0.1647	5.07 : 1
Three of a kind or two pair	5	0.1064	8.40 : 1	0.1087	8.20 : 1	0.2035	3.91 : 1
Either pair	6	0.1277	6.83 : 1	0.1304	6.67 : 1	0.2414	3.14 : 1
Full house or four of a kind;[4] Inside straight or high pair	7	0.1489	5.71 : 1	0.1522	5.57 : 1	0.2704	2.59 : 1
Open-ended straight	8	0.1702	4.88 : 1	0.1739	4.75 : 1	0.3145	2.18 : 1
Flush	9	0.1915	4.22 : 1	0.1957	4.11 : 1	0.3497	1.86 : 1
Inside straight or pair	10	0.2128	3.70 : 1	0.2174	3.60 : 1	0.3839	1.60 : 1
Open-ended straight or high pair	11	0.2340	3.27 : 1	0.2391	3.18 : 1	0.4172	1.40 : 1
Inside straight or flush; Flush or high pair	12	0.2553	2.92 : 1	0.2609	2.83 : 1	0.4496	1.22 : 1
	13	0.2766	2.62 : 1	0.2826	2.54 : 1	0.4810	1.08 : 1
Open-ended straight or pair	14	0.2979	2.36 : 1	0.3043	2.29 : 1	0.5116	0.955 : 1
Open-ended straight or flush; Flush or pair; Inside straight, flush or high pair	15	0.3191	2.13 : 1	0.3261	2.07 : 1	0.5412	0.848 : 1
	16	0.3404	1.94 : 1	0.3478	1.88 : 1	0.5698	0.755 : 1
	17	0.3617	1.76 : 1	0.3696	1.71 : 1	0.5976	0.673 : 1
Inside straight or flush or pair; Open-ended straight, flush or high pair	18	0.3830	1.61 : 1	0.3913	1.56 : 1	0.6244	0.601 : 1
	19	0.4043	1.47 : 1	0.4130	1.42 : 1	0.6503	0.538 : 1
	20	0.4255	1.35 : 1	0.4348	1.30 : 1	0.6753	0.481 : 1
Open-ended straight, flush or pair	21	0.4468	1.24 : 1	0.4565	1.19 : 1	0.6994	0.430 : 1

Example drawing

1. **^** When drawing to a full house or four of a kind with a pocket pair that has hit *trips* (three of a kind) on the flop, there are 6 outs to get a full house by pairing the board and one out to make four of a kind. This means that if the turn does not pair the board or make four of a kind, there will be 3 additional outs on the river, for a total of 10, to pair the turn card and make a full house. This makes the probability of drawing to a full house or four of a kind on the turn or river 0.334 and the odds are 1.99 : 1. This makes drawing to a full house or four of a kind by the river about 8½ outs.

If a player doesn't fold before the river, a hand with at least 14 outs after the flop has a better than 50% chance to catch one of its outs on either the turn or the river. With 20 or more outs, a hand is a better than 2 : 1 favorite to catch at least one out in the two remaining cards.

Estimating probability of drawing outs - The rule of four and two

Many poker players do not have the mathematical ability to calculate odds in the middle of a poker hand. One solution is to just memorize the odds of drawing outs at the river and turn since these odds are needed frequently for making decisions. Another solution some players use is an easily calculated approximation of the probability for drawing outs, commonly referred to as the "Rule of Four and Two". With two cards to come, the percent chance of hitting ***x*** outs is about ($x \times 4$)%. This approximation gives roughly accurate probabilities up to about 12 outs after the flop, with an absolute average error of 0.9%, a maximum absolute error of 3%, a relative average error of 3.5% and a maximum relative error of 6.8%. With one card to come, the percent chance of hitting ***x*** is about ($x \times 2$)%. This approximation has a constant relative error of an 8% underestimation, which produces a linearly increasing absolute error of about 1% for each 6 outs.

A slightly more complicated, but significantly more accurate approximation of drawing outs after the flop is to use ($x \times 4$)% for up to 9 outs and ($x \times 3 + 9$)% for 10 or more outs. This approximation has a maximum absolute error of less than 1% for 1 to 19 outs and maximum relative error of less than 5% for 2 to 23 outs. A more accurate approximation for the probability of drawing outs after the turn is ($x \times 2 + (x \times 2) \div 10$)%. This is easily done by first multiplying ***x*** by 2, then rounding the result to the nearest multiple of ten and adding the 10's digit to the first result. For example, 12 outs would be $12 \times 2 = 24$, 24 rounds to 20, so the approximation is $24 + 2 = 26$%. This approximation has a maximum absolute error of less than 0.9% for 1 to 19 outs and a maximum relative error of 3.5% for more than 3 outs. The following shows the approximations and their absolute and relative errors for both methods of approximation.

Outs	Make on turn or river							Make on river						
	Actual	(x × 4)%			(x × 3 + 9)%			Actual	(x × 2)%			(x × 2 + (x × 2) ÷ 10)%		
		Est.	Error	% Error	Est.	Error	% Error		Est.	Error	% Error	Est.	Error	% Error
1	4.2553%	4%	−0.26%	6.00%	4%	−0.26%	6.00%	2.1739%	2%	−0.17%	8.00%	2%	−0.17%	8.00%
2	8.4181%	8%	−0.42%	4.97%	8%	−0.42%	4.97%	4.3478%	4%	−0.35%	8.00%	4%	−0.35%	8.00%
3	12.4884%	12%	−0.49%	3.91%	12%	−0.49%	3.91%	6.5217%	6%	−0.52%	8.00%	7%	+0.48%	7.33%
4	16.4662%	16%	−0.47%	2.83%	16%	−0.47%	2.83%	8.6957%	8%	−0.70%	8.00%	9%	+0.30%	3.50%
5	20.3515%	20%	−0.35%	1.73%	20%	−0.35%	1.73%	10.8696%	10%	−0.87%	8.00%	11%	+0.13%	1.20%
6	24.1443%	24%	−0.14%	0.60%	24%	−0.14%	0.60%	13.0435%	12%	−1.04%	8.00%	13%	−0.04%	0.33%
7	27.8446%	28%	+0.16%	0.56%	28%	+0.16%	0.56%	15.2174%	14%	−1.22%	8.00%	15%	−0.22%	1.43%
8	31.4524%	32%	+0.55%	1.74%	32%	+0.55%	1.74%	17.3913%	16%	−1.39%	8.00%	18%	+0.61%	3.50%
9	34.9676%	36%	+1.03%	2.95%	36%	+1.03%	2.95%	19.5652%	18%	−1.57%	8.00%	20%	+0.43%	2.22%
10	38.3904%	40%	+1.61%	4.19%	39%	+0.61%	1.59%	21.7391%	20%	−1.74%	8.00%	22%	+0.26%	1.20%
11	41.7206%	44%	+2.20%	5.46%	42%	+0.28%	0.67%	23.9130%	22%	−1.91%	8.00%	24%	+0.09%	0.36%
12	44.9584%	48%	+3.04%	6.77%	45%	+0.04%	0.09%	26.0870%	24%	−2.09%	8.00%	26%	−0.09%	0.33%
13	48.1036%	52%	+3.90%	8.10%	49%	−0.10%	0.22%	28.2609%	26%	−2.26%	8.00%	29%	+0.74%	2.62%
14	51.1563%	56%	+4.84%	9.47%	51%	−0.16%	0.31%	30.4348%	28%	−2.43%	8.00%	31%	+0.57%	1.86%
15	54.1166%	60%	+5.88%	10.87%	54%	−0.12%	0.22%	32.6087%	30%	−2.61%	8.00%	33%	+0.39%	1.20%
16	56.9843%	64%	+7.02%	12.31%	57%	+0.02%	0.03%	34.7826%	32%	−2.78%	8.00%	35%	+0.22%	0.62%
17	59.7595%	68%	+8.24%	13.79%	60%	+0.24%	0.40%	36.9565%	34%	−2.96%	8.00%	37%	+0.04%	0.12%
18	62.4422%	72%	+9.56%	15.31%	63%	+0.56%	0.89%	39.1304%	36%	−3.13%	8.00%	40%	+0.87%	2.22%
19	65.0324%	76%	+10.97%	16.86%	66%	+0.97%	1.40%	41.3043%	38%	−3.30%	8.00%	42%	+0.70%	1.68%
20	67.5301%	80%	+12.47%	18.47%	69%	+1.47%	2.18%	43.4783%	40%	−3.48%	8.00%	44%	+0.52%	1.20%
21	69.9352%	84%	+14.06%	20.11%	72%	+2.06%	2.95%	45.6522%	42%	−3.65%	8.00%	46%	+0.35%	0.76%
22	72.2479%	88%	+15.75%	21.80%	75%	+2.75%	3.81%	47.8261%	44%	−3.83%	8.00%	48%	+0.17%	0.36%
23	74.4681%	92%	+17.53%	23.54%	78%	+3.53%	4.74%	50.0000%	46%	−4.00%	8.00%	51%	+1.00%	2.00%

Outs

Either of these approximations is generally accurate enough to aid in most pot odds calculations.

Runner-runner outs

Some outs for a hand require drawing an out on both the turn and the river—making two consecutive outs is called a *runner-runner*. Examples would be needing two cards to make a straight, flush, or three or four of a kind. Runner-runner outs can either draw from a common set of outs or from disjoint sets of outs. Two disjoint outs can either be conditional or independent events.

Common outs

Drawing to a flush is an example of drawing from a common set of outs. Both the turn and river need to be the same suit, so both outs are coming from a common set of outs—the set of remaining cards of the desired suit. After the flop, if *x* is the number of common outs, the probability *P* of drawing runner-runner outs in Texas hold 'em is

$$P = \frac{x}{47} \times \frac{x-1}{46}. = \frac{x^2 - x}{2,162}$$

Since a flush would have 10 outs, the probability of a runner-runner flush draw is $\frac{10}{47} \times \frac{9}{46} = \frac{90}{2162} \approx \frac{1}{24} \approx 0.04163$. Other examples of runner-runner draws from a common set of outs are drawing to three or four of a kind. When counting outs, it is convenient to convert runner-runner outs to "normal" outs (see "After the flop"). A runner-runner flush draw is about the equivalent of one "normal" out.

The following table shows the probability and odds of making a runner-runner from a common set of outs and the equivalent normal outs.

Likely drawing to	Common outs	Probability	Odds	Equivalent outs
Four of a kind (with pair) Inside-only straight flush	2	0.00093	1,080 : 1	0.02
Three of a kind (with no pair)	3	0.00278	359 : 1	0.07
	4	0.00556	179 : 1	0.13
	5	0.00925	107 : 1	0.22
Two pair or three of a kind (with no pair)	6	0.01388	71.1 : 1	0.33
	7	0.01943	50.5 : 1	0.46
	8	0.02590	37.6 : 1	0.61
	9	0.03330	29.0 : 1	0.78
Flush	10	0.04163	23.0 : 1	0.98

Disjoint outs

Two outs are disjoint when there are no common cards between the set of cards needed for the first out and the set of cards needed for the second out. The outs are independent of each other if it does not matter which card comes first, and one card appearing does not affect the probability of the other card appearing except by changing the number of remaining cards; an example is drawing two cards to an inside straight. The outs are conditional on each other if the number of outs available for the second card depends on the first card; an example is drawing two cards to an outside straight.

After the flop, if *x* is the number of independent outs for one card and *y* is the number of outs for the second card, then the probability *P* of making the runner-runner is

$$P = \frac{x}{47} \times \frac{y}{46} \times 2 = \frac{xy}{1081}.$$

For example, a player holding **J♦ Q♦** after the flop **9♥ 5♣ 4♠** needs a **10** and either a **K** or **8** on the turn and river to make a straight. There are 4 **10**s and 8 kings and **8**s, so the probability is $\frac{4\times 8}{1081} \approx 0.0296$.

The probability of making a conditional runner-runner depends on the condition. For example, a player holding **9♥ 10♥** after the flop **8♦ 2♠ A♣** can make a straight with {**J**, **Q**}, {**7**, **J**} or {**6**, **7**}. The number of outs for the second card is conditional on the first card—a **Q** or **6** (8 cards) on the first card leaves only 4 outs (**J** or **7**, respectively) for the second card, while a **J** or **7** (8 cards) for the first card leaves 8 outs ({**Q**, **7**} or {**J**, **6**}, respectively) for the second card. The probability *P* of a runner-runner straight for this hand is calculated by the equation

$$P = \left(\frac{8}{47} \times \frac{4}{46}\right) + \left(\frac{8}{47} \times \frac{8}{46}\right) = \frac{96}{2162} \approx 0.0444$$

The following table shows the probability and odds of making a runner-runner from a disjoint set of outs for common situations and the equivalent normal outs.

Drawing to	Probability	Odds	Equivalent outs
Outside straight	0.04440	21.5 : 1	1.04
Inside+outside straight	0.02960	32.8 : 1	0.70
Inside-only straight	0.01480	66.6 : 1	0.35
Outside straight flush	0.00278	359 : 1	0.07
Inside+outside straight flush	0.00185	540 : 1	0.04

The preceding table assumes the following definitions.

Outside straight and straight flush

Drawing to a sequence of three cards of consecutive rank from **3-4-5** to **10-J-Q** where two cards can be added to either end of the sequence to make a straight or straight flush.

Inside+outside straight and straight flush

Drawing to a straight or straight flush where one required rank can be combined with one of two other ranks to make the hand. This includes sequences like **5-7-8** which requires a **6** plus either a **4** or **9** as well as the sequences **J-Q-K**, which requires a **10** plus either a **9** or **A**, and **2-3-4** which requires a **5** plus either an **A** or **6**.

Inside-only straight and straight flush

Drawing to a straight or straight flush where there are only two ranks that make the hand. This includes hands such as **5-7-9** which requires a **6** and an **8** as well as **A-2-3** which requires a **4** and a **5**.

Compound outs

The strongest runner-runner probabilities lie with hands that are drawing to multiple hands with different runner-runner combinations. These include hands that can make a straight, flush or straight flush, as well as four of a kind or a full house. Calculating these probabilities requires adding the compound probabilities for the various outs, taking care to account for any shared hands. For example, if *Ps* is the probability of a runner-runner straight, *Pf* is the probability of a runner-runner flush, and *Psf* is the probability of a runner-runner straight flush, then the compound probability *P* of getting one of these hands is

$P = Ps + Pf - Psf$.

The probability of the straight flush is subtracted from the total because it is already included in both the probability of a straight and the probability of a flush, so it has been added twice and must therefore be subtracted from the compound outs of a straight or flush.

The following table gives the compound probability and odds of making a runner-runner for common situations and the equivalent normal outs.

Drawing to	Probability	Odds	Equivalent outs
Flush, outside straight or straight flush	0.08326	11.0 : 1	1.98
Flush, inside+outside straight or straight flush	0.06938	13.4 : 1	1.65
Flush, inside-only straight or straight flush	0.05550	17.0 : 1	1.30

Some hands have even more runner-runner chances to improve. For example, holding the hand **J♠ Q♠** after a flop of **10♠ J♥ 7♦** there are several runner-runner hands to make at least a straight. The hand can get two cards from the common outs of {**J**, **Q**} (5 cards) to make a full house or four of a kind, can get a **J** (2 cards) plus either a **7** or **10** (6 cards) to make a full house from these independent disjoint outs, and is drawing to the compound outs of a flush, outside straight or straight flush. The hand can also make {**7**, **7**} or {**10**, **10**} (each drawing from 3 common outs) to make a full house, although this will make four of a kind for anyone holding the remaining **7** or **10** or a bigger full house for anyone holding an overpair. Working from the probabilities from the previous tables and equations, the probability *P* of making one of these runner-runner hands is a compound probability

$$P = 0.08326 + 0.00925 + \frac{2 \times 6}{1081} + (0.00278 \times 2) \approx 0.1092$$

and odds of 8.16 : 1 for the equivalent of 2.59 normal outs. Almost all of these runner-runners give a winning hand against an opponent who had flopped a straight holding **8**, **9**,[Note 4] but only some give a winning hand against **A♠ 2♠** (this hand makes bigger flushes when a flush is hit) or against **K♣ Q♦** (this hand makes bigger straights when a straight is hit with **8 9**). When counting outs, it is necessary to adjust for which outs are likely to give a winning hand—this is where the skill in poker becomes more important than being able to calculate the probabilities.

Notes

1. **^** The odds presented in this article use the notation **x : 1** which translates to *x to 1 odds against* the event happening. The odds are calculated from the

probability ***p*** of the event happening using the formula: odds = [(1 − *p*) ÷ *p*] : 1, or odds = [(1 ÷ *p*) − 1] : 1. Another way of expressing the odds x : 1 is to state that there is a *1 in x+1* chance of the event occurring or the probability of the event occurring is 1/(x+1). So for example, the odds of a roll of a fair six-sided die coming up three is 5 : 1 against because there are 5 chances for a number other than three and 1 chance for a three; alternatively, this could be described as a 1 in 6 chance or

2. ^ ***a b*** By removing reflection and applying aggressive search tree pruning, it is possible to reduce the number of unique head-to-head hand combinations from 207,025 to 47,164. Reflection eliminates redundant calculations by observing that given hands *h*1 and *h*2, if *w*1 is the probability of *h*1 beating *h*2 in a showdown and *s* is the probability of *h*1 splitting the pot with *h*2, then the probability *w*2 of *h*2 beating *h*1 is *w*2 = 1 − (*s* + *w*1), thus eliminating the need to evaluate *h*2 against *h*1. Pruning is possible, for example, by observing that **Q♥ J♥** has the same chance of winning against both **8♢ 7♢** and **8♢ 7♢** (but *not* the same probability as against **8♥ 7♢** because sharing the heart affects the flush possibilities for each hand).
3. **^** See "Capital Pi notation for multiplication" for a description of the ∏ (capital π or pi) symbol.
4. **^** In the example, if the opponent is holding either **8♥ 9♥** or **8♢ 9♢**, then the opponent wins with a flush if the player makes a straight using two hearts or two diamonds, respectively. If the opponent is holding **8♢ 9♢**, then the opponent wins with a straight flush if the player makes a full house with **10♢ J♢**.

Poker tournaments

A **poker tournament** is a tournament where players compete by playing poker. It can feature as few as two players playing on a single table (called a "heads-up" tournament), and as many as tens of thousands of players playing on thousands of tables. The winner of the tournament is usually the person who wins every poker chip in the game and the others are awarded places based on the time of their elimination. To facilitate this, in most tournaments, blinds rise over the duration of the tournament. Unlike in a ring game (or cash game), a player's chips in a tournament cannot be cashed out for money and serve only to determine the player's placing.

Buy-ins and prizes

To enter a typical tournament, a player pays a fixed *buy-in* and at the start of play is given a certain quantity of tournament poker chips. Commercial venues may also charge a separate fee, or withhold a small portion of the buy-in, as the cost of running the event. Tournament chips have only notional value; they have no cash value, and only the tournament chips, not cash, may be used during play. Typically, the amount of each entrant's starting tournament chips is an integer multiple of the buy-in. Some tournaments offer the option of a *re-buy* or *buy-back*; this gives players the option of purchasing more chips. In some cases, re-buys are conditional (for example, offered only to players low on or out of chips) but in others they are available to all players (called *add-ons*). When a player has no chips remaining (and has exhausted or declined all re-buy options, if any are available) he or she is eliminated from the tournament.

In most tournaments, the number of players at each table is kept even by moving players, either by switching one player or (as the field shrinks) taking an entire table out of play and distributing its players amongst the remaining tables. A few tournaments, called *shoot-outs*, do not do this; instead, the last player (sometimes the last two or more players) at a table moves on to a second or third round, akin to a single-elimination tournament found in other games.

The prizes for winning are usually derived from the buy-ins, though outside funds may be entered as well. For example, some invitational tournaments do not have buy-ins and fund their prize pools with sponsorship revenue and/or gate receipts from spectators. (These tournaments are referred to as freerolls.) Play continues, in most tournaments, until all but one player is eliminated, though in some tournament situations, especially informal ones, players have the option of ending by consensus.

Players are ranked in reverse chronological order — the last person in the game earns 1st place, the second-to-last earns 2nd, and so on. This ranking of players by elimination is unique amongst games, and also precludes the possibility of a tie for first place, since one player alone must have all the chips to end the tournament. (Ties are possible for all other places, though they are rare since the sole tiebreaker is the number of chips one has at the start of the hand in which one is eliminated, and hence two people would need to start a hand with exactly the same number of chips and both be eliminated on that same hand in order to tie with each other.)

Sometimes tournaments end by mutual consensus of the remaining players. For example, in a ten-person, $5 game, there may be two players remaining with $29 and $21, respectively, worth of chips. Rather than risk losing their winnings, as one of them would if the game were

continued, these two players may be allowed to split the prize proportional to their in-game currency (or however they agree).

Certain tournaments, known as bounty tournaments, place a bounty on some or all of the players. If a player knocks an opponent out, the player earns the opponent's bounty. Individual bounties or total bounties collected by the end of a tournament may be used to award prizes. Bounties usually work in combination with a regular prize pool, where a small portion of each player's buy-in goes towards his or her bounty.

Other tournaments allow players to exchange some or all of their chips in the middle of a tournament for prize money, giving the chips cash value. Separate portions of each player's buy-in go towards a prize pool and a "cash out" pool. The cash out rate is typically fixed, and a time when players may not cash out (such as the final table) is usually established. The remaining cash out pool is either paid out to the remaining field or added to the regular prize pool.

Prizes are awarded to the winning players in one of two ways:

- *Fixed*: Each placing corresponds to a certain payoff. For example, a ten-person, $20 buy-in tournament might award $100 to the first-place player, $60 for second-place, $40 for third, and nothing for lower places.
- *Proportional*: Payouts are determined according to a percentage-based scale. The percentages are determined based upon the number of participants and will increase payout positions as participation increases. As a rule, roughly one player in ten will 'cash', or make a high enough place to earn money. These scales are very top-heavy, with the top three players usually winning more than the rest of the paid players combined.

Tournaments can be open or invitational. The World Series of Poker, whose Main Event (a $10,000 buy-in no limit Texas Hold 'Em tournament) is considered the most prestigious of all poker tournaments, is open.

Multi-table tournaments involve many players playing simultaneously at dozens or even hundreds of tables. *Satellite tournaments* to high-profile, expensive poker tournaments are the means of entering a major event without posting a significant sum of cash. These have significantly smaller buy-ins, usually on the order of one-tenth to one-fiftieth the main tournament's buy-in, and can be held at various venues and, more recently, on the Internet. Top players in this event, in lieu of a cash prize, are awarded seats to the main tourney, with the number of places dependent on participation. Chris Moneymaker, who won the 2003 World Series of Poker Main Event, was able to afford his seat by winning an Internet tournament with a $39 buy-in. Greg Raymer, 2004 World Series of Poker champion, acquired his seat via a $165 Internet tournament.

The opposite of a multi-table tournament is a *single-table tournament*, often abbreviated *STT*. A number of places (typically, nine or ten) are allocated at a single table, and as soon as the required number of players has appeared, chips are distributed and the game starts. This method of starting single-table tournaments has caused them to be referred to as *sit-and-go* (*SNG*) tournaments, because when the required number of players "sit," the tournament "goes." Sit-and-go tournaments of more than one table are becoming more common, however, especially in Internet poker. A single-table tournament effectively behaves the same as the final table of a multi-table tournament, except that the players all begin with the same number of chips, and the

betting structure starts much lower than would likely be the case at a MTT final table. Almost invariably, fixed payoffs are used.

A tournament series may consist of either single-table or multi-table tournaments. In a tournament series, multiple tournaments are played in which prizes are awarded. However, a series leaderboard or standings system is often used and additional prizes, drawn from the individual tournament buy-ins, are awarded to those who perform best overall in the series. Major poker tournaments such as the World Poker Tour and World Series of Poker, use standings to determine a player of the year.

Playing format

The most common playing format for poker tournaments is the knockout (also known as "freezeout") format. All players still playing in a tournament constitute a dynamic pool. Whenever a player loses all his chips and gets eliminated, his table shrinks. To combat the constant shrinking of tables and avoid having tables play with varying numbers of players, players are moved between tables, with unnecessary tables getting closed as the tournament progresses. In the end, all remaining players are seated on just one table, known as the "final table". Most sit and go tournaments are knockouts.

In some tournaments, known as "rebuy tournaments", players have the ability to re-buy into the game in case they lost all their chips and avoid elimination for a specific period of time (usually ranging from one to two hours). After this so-called "rebuy period", the play resumes as in a standard knockout tournament and eliminated players do not have the option of returning to the game any more. Rebuy tournaments often allow players to rebuy even if they have not lost all their chips, in which case the rebuy amount is simply added to their stack. A player is not allowed to rebuy in-game if he has too many chips (usually the amount of the starting stack or half of it). At the end of the rebuy period remaining players are typically given the option to purchase an "add-on", an additional amount of chips, which is usually similar to the starting stack.

Another playing format is the "shootout" tournament. A shootout tournament divides play in rounds. In a standard shootout tournament, 2-10 players sit on each table and the table roster remains the same until everyone but one player is eliminated. The table winners progress to the final table where the tournament winner is determined. In a shootout tournament players are usually awarded places in tiers based on how many rounds they lasted and in which place they were eliminated. Shootouts can include multiple rounds (triple, quadruple or quintuple shootout) or feature several players from each table progressing (usually up to three). Shootouts are also a common format for large heads-up multi-table tournaments, although these may feature double or triple elimination instead of the standard single knockout method.

Betting format

Betting in tournaments can take one of three forms:

- In a *structured* (fixed limit) betting system, bets and raises are restricted to specific amounts, though these amounts typically increase throughout the tournament. For example, for a seven-card stud tournament with the stakes at

10/20, raises would be $10 in the first three rounds of betting, and $20 in the latter rounds.

- *Semi-structured* betting provides ranges for allowed raises. Usually, in this format, one may not raise less than a previous player has raised. For example, if one player raises $20, it would be illegal for another player to raise an additional $5. Pot limit is a semi-structured format in which raises cannot exceed the current size of the pot. Spread limit is a semi-structured format in which bets (and subsequent raises) must be between a minimum and maximum amount.
- *Unstructured* betting, usually called no limit. While blinds, antes, or bring-ins are fixed, players are free to bet as much as they wish, even early in a round of betting. To bet all of one's chips (risking one's tournament life, in the event of losing the hand) is to go *all-in*. In no-limit tournaments, players will sometimes take this risk even early in the betting; for example, in some no-limit Texas Hold 'Em tournaments, it is not uncommon for players to bet "all-in" before the flop.

The betting structure is one of the most defining elements of the game; even if other aspects are equivalent, a fixed-limit version and its no-limit counterpart are considered to be very *different* games, because the strategies and play styles are very different. For instance, it is much easier to bluff in a no-limit game, which allows aggressive betting, than in a fixed-limit game. No-limit games also vary widely according to the proclivities of the players; an informal, emergent, betting structure is developed by the players' personal strategies and personalities.

The stakes of each round, as well as blinds, bring-ins, and antes as appropriate per game, typically escalate according either to the time elapsed or the number of hands played.

Variants of poker

While some tournaments offer a mix of games, like H.O.R.S.E. events which combine Hold'em, Omaha, Razz, Stud and Stud Eight or Better and Dealer's Choice events, at which one may choose from a similar menu of games, most tournaments feature one form of stud or community card poker, such as seven-card stud, seven card high-low stud, Omaha Hold 'em or Texas Hold 'em. Both Omaha and Texas Hold'em tournaments are commonly offered in fixed-limit and pot limit, and no limit Texas hold 'em tournaments are very common (no-limit Omaha is almost nonexistent in tournament play).

Sit and gos are another specific type of poker tournament. Regular tournaments begin at a scheduled time, and however many players are registered for that tournament when the starting time approaches, is the number of players that make up that specific tournament. Sit and gos are formatted the same as regular tournaments, except they begin when a certain amount of players register for it. Standard sit and gos usually consist of 2,6,9,10,12,18,24,27,36,45,90,100 or 180 players. Sit and gos are formatted the same as regular tournaments; everyone buys-in to the sit and go for the same amount and every player starts with the same amount of chips. Each player in a sit and go plays until all of their chips are gone. As each player is knocked out, they receive money (or don't receive money) according to what place they finish. First place makes the most money, second is rewarded with a little less than first, and so on. Unlike cash games, standard sit and go tournaments increase the blinds and antes every 15 minutes or so in equal intervals. Some

sit and gos, called winner-take-all, only reward first prize with money, which receives all of the money that the sit and go consisted of from all of the buy-ins from every player in it. Other sit and gos, usually only heads up (1-on-1) sit and gos, don't ever increase the blinds. The blinds stay the same throughout the entire sit and go, causing much more skillful play to be rewarded over the long run, as players aren't as forced to play mediocre hands because of big blinds and antes.

Tournament venues

Informal tournaments can be organized by a group of friends; for example, most colleges feature poker tournaments. Casinos and online gaming sites often offer daily tournaments.

However, these are not the only venues. Poker cruises offer tournaments at sea. Most 2005 and 2006 World Series of Poker events took place in the convention center at the Rio Hotel in Las Vegas.

Major tournaments

The two largest and most well-known tournaments in the USA are the World Poker Tour championship event and the World Series of Poker, both held in Las Vegas. The World Series has traditionally been featured on ESPN. In the 1980s the Super Bowl of Poker was the second largest and most prestigious tournament.

The 2005 World Series of Poker was the first held outside of Binion's Horseshoe Casino, though the final few days of the main event were held in the legendary Benny's Bullpen. Later tournaments have been held at one of the Harrah's Entertainment properties; since 2005, the Rio has served as the venue.

The largest and most well-known tournament in Europe is the European Poker Tour, which was founded in 2004 by John Duthie and is now the largest poker tour in the world by both total players and prize pool. The WSOP Europe started in 2007 and has one stop, in London.

The largest and most well-known tournament in Asia is the Asia Pacific Poker Tour Macau event.

The largest and most well-known tournament in Latin America is the Latin American Poker Tour Argentina event.

The Crown Australian Poker Championship, also known as the **Aussie Millions**, is the largest tournament in the Pacific region.

In addition to these events, there are other major tournaments throughout the year. The World Poker Tour broadcasts a series of open tournaments throughout the U.S. and Caribbean with buy-ins from $5,000 to $25,000, as well as a European event with a €10,000 buy-in. Some of these events are stand alone tournaments like the Caribbean Poker Adventure, but most are held in conjunction with a tournament series being held at the host casino, like the Commerce Casino's LA Poker Classic, the Grand Sierra's World Poker Challenge and the Bicycle Casino's Legends of Poker. A North American Poker Tour was launched in 2010.

Atlantic City hosts The United States Poker Championship at the Trump Taj Mahal casino, which has been broadcast by ESPN in recent years.

The main live poker tournament in Africa is the All Africa Poker Tournament hosted by the Piggs Peak Casino in Piggs Peak, Swaziland.

The National Heads-Up Poker Championship is a tournament modeled similarly to the NCAA tournament for college basketball. 64 players compete in heads-up matches single elimination style to determine a winner. It is one of the most prestigious heads up poker tournaments and it is the first tournament produced by a television network.

The internet poker revolution has sparked online poker tournaments and series that have become larger than many live tournaments. The World Championship of Online Poker (WCOOP) and the Full Tilt Online Poker Series (FTOPS) are two of the biggest online poker tournament series, with tournament prizes surpassing the million-dollar mark.

Satellite tournaments

A **satellite tournament** is either a minor tournament or event on a competitive sporting tour or one of a group of such tournaments that form a series played in the same country or region.

A satellite tournament in poker is a qualifying event. Winners of these satellites usually win the buy-in fee to a larger, more prestigious tournament like the World Series of Poker Main Event. Although there are some land-based satellite tournaments (usually for very high stakes tournaments), most of them are online-based. Some sites, like PokerStars, maintain several tiers of satellites. A player can thus start out at one tier (not necessarily the lowest one) and play his way to a higher tier. The entry fee for each tier is always higher than the fee for the tier below it, with the first tier being the cheapest.